

IN THE SPECIFICATION:

After the Title of the Invention and before line 1, insert the following new heading and paragraph:

--Cross-Reference to Related Applications

This application is a U.S. national stage application of copending International Application Ser. No. PCT/JP99/05725, filed October 15, 1999 claiming a priority date of October 19, 1998, and published in a non-English language.--

Please insert the following new heading after the title and before line 1 of page 1:

BACKGROUND OF THE INVENTION

Heading at line 1 of page 1 has been amended as follows:

~~TECHNICAL FIELD~~ Field of the Invention

Paragraph beginning at line 2 of page 1 has been amended as follows:

The present invention relates to an information reproducing apparatus and an information recording apparatus capable of further promoting a recording density by using a reproducing and recording system using near-field light, and to as well as a recording medium, an information reproducing

method and an information recording method used in information reproduction or recording utilizing near-field light.

Heading at line 9 of page 1 has been amended as follows:

BACKGROUND OF ~~THE~~ INFORMATION

Paragraph beginning at line 10 of page 1 has been amended as follows:

In recent years, the promotion of a recording density of information reproducing/recording apparatus starting from a hard disk apparatus ~~begins to stagnate~~ has lost interest and there ~~has been searched to grope~~ is now an interest for a new reproducing and recording system in place of an existing system in order to promote the recording density. At present, as a technology ~~of~~ for outstandingly promoting such a recording density, there has been proposed an information reproducing system using near-field ~~light,~~ light of which has already been reduced into practice in the United States.

Paragraph beginning at line 3 of page 2 has been amended as follows:

Near-field light is provided with a high resolution equal to or higher than the diffraction limit of light and, accordingly, a pit on an information recording medium can be

made further smaller than that in a conventional system. Therefore, the recording density can be increased up to several tens G bits / square inch. According to the system, the recording density does not depend on the wavelength of light but on the very small shape or size at a front end of a head.

Heading at line 6 of page 3 has been amended as follows:

~~DISCLOSURE OF THE INVENTION~~ SUMMARY OF THE INVENTION

Paragraph beginning at line 7 of page 3 has been amended as follows:

In order to achieve the above-described object, according to an embodiment of the invention, ~~Claim 1~~, there is provided an information reproducing apparatus for forming a mark of an edge in a linear shape having a predetermined angle relative to a scanning direction or the like on a medium, irradiating the mark with near-field light of linearly polarized light orthogonal to the mark, and acquiring scattered light scattered by the mark as an output signal.

Paragraph beginning at line 9 of page 4 has been amended as follows:

Further, according to ~~Claim 2~~ another embodiment, there is provided an information reproducing apparatus for

forming a plurality of marks of edges in a linear shape or the like on a medium by changing directions of the marks, scanning the medium while irradiating the marks with near-field light of linearly polarized light, constituting output signals by scattered light scattered by the marks, and acquiring multiple value data from intensities of the output signals.

Paragraph beginning at line 11 of page 5 has been amended as follows:

Further, according to another embodiment ~~Claim 3~~, there is provided an information reproducing apparatus comprising a tracking mark of an edge in a linear shape or the like formed on a medium in a scanning direction, and a very small aperture for tracking for scanning a vicinity of the tracking mark along the tracking mark and generating near-field light polarized in a direction orthogonal to the scanning direction by receiving light from a light source, wherein an output signal is acquired from scattered light scattered by the tracking mark and tracking in reproduction is executed based on an intensity of the output signal.

Paragraph beginning at line 10 of page 6 has been amended as follows:

Further, according to another embodiment ~~Claim 4~~, there is provided an information reproducing apparatus

comprising a tracking mark of an edge in a linear shape or the like formed on a medium in a scanning direction, a data mark of an edge in a linear shape or the like formed in a direction orthogonal to the scanning direction, a very small aperture for data access for orthogonally scanning the data mark and generating near-field light polarized in the scanning direction by receiving light from a light source, and a very small aperture for tracking for scanning a vicinity of the tracking mark along the tracking mark and generating near-field light polarized in the direction orthogonal to the scanning direction by receiving light from a light source, wherein an output signal is acquired from scattered light scattered by the tracking mark, tracking is executed based on an intensity of the output signal, an output signal is acquired from scattered light scattered by the data mark and data is acquired based on an intensity of the output signal.

Paragraph beginning at line 2 of page 7 has been amended as follows:

Tracking thereof is similar to that in the invention according to the last described embodiment ~~Claim 3~~. With regard to data access, the data mark is formed in the direction orthogonal to the scanning direction, that is, a direction different from that of the tracking mark and is

scanned by the near-field light of the linearly polarized light orthogonal to the data mark. In this way, even when the data mark and the tracking mark are formed on the same track, or even when a single pit is formed by the tracking mark and the data mark, the two marks can be separately detected. As a result, an area of the tracking mark (or data mark) can be reduced and accordingly, the recording density can be promoted.

Paragraph beginning at line 14 of page 7 has been amended as follows:

Further, according to ~~Claim 5~~ another embodiment, there is provided an information reproducing apparatus comprising a very small aperture for first data access for generating near-field light polarized in a scanning direction by receiving light from a light source, a very small aperture for second data access for generating near-field light polarized in a direction orthogonal to the scanning direction by receiving light from a light source, and a data mark of an edge or the like formed in the scanning direction and/or the direction orthogonal to the scanning direction based on recorded information, wherein the near-field light polarized in the scanning direction by the very small aperture for the first data access is scattered by a data mark formed in the direction orthogonal to the scanning direction, first data is

acquired based on an intensity of light scattered thereby, similarly, the near field light polarized in the direction orthogonal to the scanning direction by the very small aperture for the second data access is scattered by a data mark formed in the scanning direction, second data is acquired based on an intensity of light scattered thereby and multiple value data is acquired from the first data and the second data.

Paragraph beginning at line 7 of page 9 has been amended as follows:

Further, according to ~~Claim 6~~ another embodiment, there is provided an information reproducing apparatus comprising one very small aperture for data access for generating near-field light having linearly polarized light by receiving light from a light source, polarized light rotating means provided between the light source and the very small aperture for data access for rotating a direction of polarization of the near-field light, and a data mark of an edge or the like formed in the scanning direction and/or a direction orthogonal to the scanning direction based on recorded information, wherein the data mark is scanned by the near-field light polarized in the scanning direction or the direction orthogonal to the scanning direction, successively, the same data mark is scanned by the near-field

light polarized in the direction orthogonal to the scanning direction or the scanning direction, the near-field light polarized in the scanning direction is scattered by the data mark formed in the direction orthogonal to the scanning direction, first data is acquired based on an intensity of the scattered light, similarly, the near-field light polarized in the direction orthogonal to the scanning direction is scattered by the data mark formed in the scanning direction, second data is acquired based on an intensity of the scattered light and multiple value data is acquired from the first data and the second data.

Paragraph beginning at line 2 of page 11 has been amended as follows:

Further, according to ~~Claim 7~~ another embodiment, there is provided an information reproducing apparatus according to the above described information reproducing apparatus, further comprising bit shift operating means for subjecting either one of the first data and the second data to bit shift and adding the either one to other thereof.

Paragraph beginning at line 15 of page 11 has been amended as follows:

Further, according to ~~Claim 8~~ another embodiment, there is provided an information reproducing apparatus

comprising a data mark of an edge in a linear shape having a predetermined angle relative to a scanning direction or the like formed on a medium, a very small aperture for generating near-field light having linearly polarized light by receiving light from a light source, polarized light rotating means provided between the light source and the very small aperture for rotating a direction of polarization of the near-field light, wherein the medium is scanned while irradiating the data mark with the near-field light a direction of polarization of which is rotating, scattered light scattered by the data mark constitutes an output signal and multiple value data is acquired from an intensity of the output signal and a rotational angle of the direction of polarization.

Paragraph beginning at line 10 of page 13 has been amended as follows:

Further, according to ~~Claim 9~~ another embodiment, there is provided an information reproducing apparatus forming data marks of edges in a linear shape or the like on a medium at predetermined intervals based on recorded information, scanning the medium while irradiating the data marks with near-field light having linearly polarized light orthogonal to the data marks and acquiring data from intervals of intensities of output signals by scattered light scattered by the data marks.

Paragraph beginning at line 3 of page 14 has been amended as follows:

Further, according to ~~Claim 10~~ another embodiment, there is provided an information reproducing apparatus providing data marks of a plurality of edges directed in different directions or the like as one unit, the information reproducing apparatus comprising a very small aperture for generating near-field light having linearly polarized light by receiving light from a light source, and polarized light rotating means provided between the light source and the very small aperture for rotating a direction of polarization of the near-field light, wherein the one unit of the plurality of data marks is irradiated with the near-field light the direction of polarization of which is rotating, scattered light scattered by the respective data marks constitutes output signals and multiple value data is acquired from intensities of the output signals and rotational angles of the direction of polarization.

Paragraph beginning at line 18 of page 14 has been amended as follows:

The information reproducing apparatus according to ~~Claim 10 is provided with a way of thinking~~ this embodiment is substantially similar to the invention according to the previously described embodiment except ~~Claim 8 and featured in~~

that the data marks are provided with a plurality of the data marks directed in different directions as one unit. When there is a relative relationship between the data mark formed in one direction and the near-field light of the linearly polarized light orthogonal to the data mark, an influence is not effected by the data mark formed in other direction and even in the case of the data marks formed in a plurality of directions, these can be separately detected. Further, an optical system is simplified by rotating the direction of polarization. Finally, multiple value data is acquired from the rotational angles and intensities of the output signals. In the case of the constitution, even when the data marks are formed by one unit, the data marks can separately be detected and accordingly, multiple value formation is made possible. Further, in an actual multiple value formation stage, the above-described bit shift means. or the like can be used.

Paragraph beginning at line 11 of page 15 has been amended as follows:

Further, according to ~~Claim 11~~ another embodiment, there is provided an information recording apparatus changing a direction of polarization of near-field light having linearly polarized light based on recorded information and irradiating a medium a surface of which is provided with a substance a state of which is changed by local heating with

the near-field light to thereby record multiple value data.

Paragraph beginning at line 9 of page 16 has been amended as follows:

Further, according to ~~Claim 12~~ another embodiment, there is provided an information recording apparatus comprising a very small aperture for first data recording for generating near-field light polarized in a scanning direction by receiving light from a light source, a very small aperture for second data recording for generating near-field light polarized in a direction orthogonal to the scanning direction by receiving light from a light source, and a medium a surface of which is provided with a substance a state of which is changed by local heating, wherein first data is recorded by irradiating the medium with the near-field light polarized in the scanning direction by the very small aperture for the first data recording and changing the state in the direction orthogonal to the scanning direction, similarly, second data is recorded by irradiating the medium with the near-field light polarized in the direction orthogonal to the scanning direction by the very small aperture for the second data recording and changing the state in the scanning direction to thereby record information by multiple value data.

Paragraph beginning at line 12 of page 17 has been as follows:

Further, according to ~~Claim 13~~ another embodiment, there is provided an information recording apparatus comprising one very small aperture for data recording for generating near-field light having linearly polarized light by receiving light from a light source, polarized light rotating means provided between the light source and the very small aperture for data recording for rotating a direction of polarization of the near-field light, and a medium a surface of which is provided with a substance a state of which is changed by local heating, wherein first data is recorded by irradiating the medium with the near-field light polarized in a scanning direction or a direction orthogonal to the scanning direction by the very small aperture for data recording and changing the state in the direction orthogonal to the scanning direction or the scanning direction, successively, second data is recorded by irradiating the medium with the near-field light polarized in the direction orthogonal to the scanning direction or the scanning direction and changing the state in the scanning direction or the direction orthogonal to the scanning direction to thereby record information by multiple value data.

Paragraph beginning at line 1 of page 19 has been amended as follows:

Further, according to ~~Claim 14~~, another embodiment, there is provided an information recording apparatus comprising one very small aperture for data recording for generating near-field light having linearly polarized light by receiving light from a light source, polarized light rotating means provided between the light source and the very small aperture for data recording for rotating a direction of polarization of the near-field light, and a medium a surface of which is provided with a substance a state of which is changed by local heating, wherein irradiation of the near-field light is controlled by a unit of a predetermined rotational angle based on recorded information and the state in a direction orthogonal to the direction of polarization of the near-field light is changed by the unit of the rotational angle to thereby record information by multiple value data.

Paragraph beginning at line 24 of page 19 has been amended as follows:

Further, according to ~~Claim 15~~ another embodiment, there is provided an information recording apparatus according to the above described information recording apparatus, wherein the unit of the rotational angle is made to be equal to or larger than 10 degrees.

Paragraph beginning at line 9 of page 20 has been amended as follows:

Further, according to ~~Claim 16~~ another embodiment, there is provided an information reproducing apparatus comprising a first laser oscillator used for tracking, a second laser oscillator used for data access, a phase plate for providing phase shift between the first laser oscillator and the second laser oscillator, a first very small aperture for generating near-field light having linearly polarized light from laser light from the first laser oscillator, and a second very small aperture for generating near-field light having linearly polarized light in a direction orthogonal to a direction of polarization of the near-field light generated by the first very small aperture from laser light from the second laser oscillator.

Paragraph beginning at line 20 of page 21 has been amended as follows:

Further, according to ~~Claim 17~~ another embodiment, there is provided an information reproducing apparatus comprising a first laser oscillator and a second laser oscillator used for data access, a phase plate for providing phase shift between the first laser oscillator and the second laser oscillator, a first very small aperture for generating near-field light having linearly polarized light from laser

light from the first laser oscillator, and a second very small aperture for generating near-field light having linearly polarized light in a direction orthogonal to a direction of polarization of the near-field light generated by the first very small aperture from laser light from the second laser oscillator.

Paragraph beginning at line 8 of page 23 has been amended as follows:

Further, according to ~~Claim 18~~ another embodiment, there is provided an information reproducing apparatus comprising a laser oscillator used for data access, a very small aperture for generating near-field light having linearly polarized light from laser light from the laser oscillator, and polarized light controlling means for controlling a direction of polarization of the near-field light.

Paragraph beginning at line 20 of page 24 has been amended as follows:

Further, according to ~~Claim 19~~ another embodiment, there is provided a record medium comprising a data mark of an edge formed in one direction or the like and a data mark of an edge formed in a direction different from the direction or the like on a track.

Paragraph beginning at line 13 of page 25 has been amended as follows:

Further, according to ~~Claim-20~~ another embodiment, there is provided a record medium forming phase change layers in a longitudinal direction a state of each of which is changed by local heating in a plurality of directions on a track.

Paragraph beginning at line 7 of page 26 has been amended as follows:

Further, according to ~~Claim-21~~ another embodiment, there is provided an information reproducing method irradiating a mark of an edge in a linear shape having a predetermined angle relative to a scanning direction or the like with near-field light of linearly polarized light substantially orthogonal to the mark and acquiring scattered light scattered by the mark as an output signal to thereby reproduce information.

Paragraph beginning at line 6 of page 27 has been amended as follows:

Further, according to ~~Claim-22~~ another embodiment, there is provided an information reproducing method forming a plurality ,of marks of edges in a linear shape in different directions or the like on a medium, scanning the medium while

irradiating the marks with near-field light of linearly polarized light, constituting scattered light scattered by the marks as output signals and acquiring multiple value data from intensities of the output signals to thereby reproduce information.

Paragraph beginning at line 7 of page 28 has been amended as follows:

Further, according to ~~Claim 23~~ another embodiment, there is provided an information reproducing method forming a tracking mark of an edge in a linear shape or the like in a scanning direction on a medium, generating near-field light polarized in a direction orthogonal to the scanning direction, scanning a vicinity of the tracking mark along the tracking mark by the near-field light, acquiring an output signal from scattered light scattered by the tracking mark and executing tracking in reproduction based on an intensity of the output signal.

Paragraph beginning at line 3 of page 29 has been amended as follows:

Further, according to ~~Claim 24~~ another embodiment, there is provided an information reproducing method comprising the steps of forming a tracking mark of an edge in a linear shape or the like in a scanning direction on a medium and

forming a data mark of an edge in a linear shape or the like in a direction orthogonal to the scanning direction, orthogonally scanning the data mark by near-field light polarized in the scanning direction and scanning a vicinity of the tracking mark along the tracking mark by near-field light polarized in a direction orthogonal to the scanning direction, and acquiring an output signal from scattered light scattered by the tracking mark, executing tracking based on an intensity of the output signal, acquiring an output signal from scattered light scattered by the data mark and acquiring data based on an intensity of the output, signal to thereby reproduce information.

Paragraph beginning at line 18 of page 29 has been amended as follows:

Tracking of the invention according to ~~Claim 24~~ this embodiment is similar to the invention according to a previously described embodiment ~~Claim 23~~. With regard to data access, the data mark is formed in the direction orthogonal to the scanning direction, that is, a direction different from that of the tracking mark and the data mark is scanned by near-field light of linearly polarized light orthogonal to the data mark. In this way, even when the data mark and the tracking mark are formed on the same track, or even when a single pit is formed by the tracking mark and the data mark,

the two marks can separately be detected. As a result, an area of the tracking mark (or the data mark) can be reduced and accordingly, the recording density can be promoted.

Paragraph beginning at line 5 of page 30 has been amended as follows:

Further, according to ~~Claim 25~~ another embodiment, there is provided an information reproducing method comprising the steps of forming data marks of edges or the like in a scanning direction and/or a direction orthogonal to the scanning direction based on recorded information and generating near-field light polarized in the scanning direction and the direction orthogonal to the scanning direction, and scattering the near-field light polarized in the scanning direction by the data mark formed in the direction orthogonal to the scanning direction, acquiring first data based on an intensity of light scattered thereby, similarly, scattering the near-field light polarized in the direction orthogonal to the scanning direction by the data mark formed in the scanning direction, acquiring second data based on an intensity of light scattered thereby and acquiring multiple value data from the first data and the second data to thereby reproduce information.

Paragraph beginning at line 3 of page 31 has been amended as follows:

Further, according to ~~Claim 26~~ another embodiment, there is provided an information reproducing method comprising the steps of forming a data mark of an edge or the like in a scanning direction and/or a direction orthogonal to the scanning direction based on recorded information, scanning the data mark by near-field light polarized in the scanning direction or the direction orthogonal to the scanning direction, successively rotating a direction of polarization of the near-field light and scanning the same data mark by the near-field light polarized in the direction orthogonal to the scanning direction or the scanning direction, and scattering the near-field light polarized in the scanning direction by the data mark formed in the direction orthogonal to the scanning direction, acquiring first data based on an intensity of light scattered thereby, similarly, scattering the near-field light polarized in the direction orthogonal to the scanning direction by the data mark formed in the scanning direction, acquiring second data based on an intensity of light scattered thereby and acquiring multiple value data from the first and the second data to thereby reproduce information.

Paragraph beginning at line 15 of page 32 has been amended as follows:

Further, according to ~~Claim-27~~ another embodiment, there is provided an information reproducing method according to the above described information reproducing method, characterized in that either one of the first data and the second data is subjected to bit shift and the either one is added to other thereof.

Paragraph beginning at line 2 of page 33 has been amended as follows:

Further, according to ~~Claim-28~~ another embodiment, there is provided an information reproducing method forming data marks of edges in a linear shape having predetermined angles relative to a scanning direction or the like on a medium, irradiating the data marks with near-field light while rotating a direction of polarization of the near-field light having linearly polarized light, constituting output signals by scattered light scattered by the data marks and acquiring multiple value data from intensities of the output signals and rotational angles at which the output signals are intensified to thereby reproduce information.

Paragraph beginning at line 13 of page 34 has been amended as follows:

Further, according to ~~Claim 29~~ another embodiment, there is provided an information reproducing method forming data marks of edges in a linear shape or the like on a medium at predetermined intervals based on recorded information, scanning the medium while irradiating the data marks with near-field light having linearly polarized light substantially orthogonal to the data marks and acquiring data from intervals of intensities of output signals by scattered light scattered by the data marks to thereby reproduce information.

Paragraph beginning at line 7 of page 35 has been amended as follows:

Further, according to ~~Claim 30~~ another embodiment, there is provided an information reproducing method providing data marks of a plurality of edges directed in different directions or the like as one unit, irradiating the one unit of the plurality of data marks with near-field light while rotating a direction of polarization of the near-field light having linearly polarized light, constituting output signals by scattered light scattered by the respective data marks and acquiring multiple value data from intensities of the output signals and rotational angles at which the output signals are intensified to thereby reproduce information.

Paragraph beginning at line 18 of page 35 has been amended as follows:

The invention according to ~~Claim 30~~ this embodiment is substantially similar to the invention according to Claim 28 and featured in that the data marks are provided with a plurality of the data marks directed in different directions as one unit. When there is a relative relationship between the data mark formed in one direction and near-field light of a linearly polarized light orthogonal to the data mark, an influence by the data mark formed in other direction is not effected and even in the case of the data marks formed in a plurality of directions, these can separately be detected. Finally, multiple value data is acquired from the rotational angles and intensities of the output signals. In the case of the constitution, even when data marks are formed by a single unit, the data marks can separately be detected and accordingly, multiple value formation is made possible. Further, in an actual multiple value formation stage, the multiple value formation is carried out by the above-described bit shift.

Paragraph beginning at line 9 of page 36 has been amended as follows:

Further, according to ~~Claim 31~~ another embodiment, there is provided an information recording method changing a

direction of polarization of near-field light having linearly polarized light based on recorded information and irradiating a medium a surface of which is provided with a substance a state of which is changed by local heating with the near-field light while changing the direction of polarization to thereby record multiple value data.

Paragraph beginning at line 2 of page 37 has been amended as follows:

Further, according to ~~Claim 32~~ another embodiment, there is provided an information recording method recording first data by irradiating a medium a surface of which is provided with a substance a state of which is changed by local heating with near-field light polarized in a scanning direction and changing the state in a direction orthogonal to the scanning direction, similarly, recording second data by irradiating the medium with near-field light polarized in a direction orthogonal to the scanning direction and changing the state in the scanning direction and recording information by multiple value data.

Paragraph beginning at line 22 of page 37 has been amended as follows:

Further, according to ~~Claim 33~~ another embodiment, there is provided an information recording method recording

first data by irradiating a medium a surface of which is provided with a substance a state of which is changed by local heating with near-field light polarized in a scanning direction or a direction orthogonal to the scanning direction and changing the state in the direction orthogonal to the scanning direction or the scanning direction, successively, rotating a direction of polarization of the near-field light, recording second data by irradiating the medium with the near-field light polarized in the direction orthogonal to the scanning direction or the scanning direction and changing the state in the scanning direction or the direction orthogonal to the scanning direction and recording information by multiple value data.

Paragraph beginning at line 5 of page 39 has been amended as follows:

Further, according to ~~Claim 34~~ another embodiment, there is provided an information recording method irradiating a medium a surface of which is provided with a substance a state of which is changed by local heating with near-field light having linearly polarized light while rotating a direction of polarization thereof, controlling the irradiation based on recorded information by a unit of a predetermined rotational angle and changing the state in a direction orthogonal to a direction of polarization of the near-field

light by the unit of the rotational angle to thereby record information by multiple value data.

Paragraph beginning at line 24 of page 39 has been amended as follows:

Further, according to ~~Claim 35~~ another embodiment, there is provided an information recording method according to the above described information recording method, wherein the unit of the rotational angle is made to be equal to or larger than 10°.

Paragraph beginning at line 9 of page 40 has been amended as follows:

~~Fig. 1 is an~~ Figs. 1A-1C are explanatory view views showing a polarized state of near-field light.

Paragraph beginning at line 12 of page 40 has been amended as follows:

~~Fig. 3 illustrates~~ Figs. 3A-3C are explanatory views showing marks formed on samples.

Paragraph beginning at line 2 of page 41 has been amended as follows:

~~Fig. 9 is an~~ Figs. 9A-9C are explanatory ~~view~~ views showing states of an output signal of the information reproducing apparatus shown in Fig. 5.

Paragraph beginning at line 12 of page 41 has been amended as follows:

~~Fig. 13 is a~~ Figs. 13A-13B are graph ~~diagram~~ diagrams showing an output intensity of a light receiving element.

Paragraph beginning at line 20 of page 41 has been amended as follows:

~~Fig. 16 is an~~ Figs. 16A-16B are explanatory ~~view~~ views showing states of data acquisition.

Paragraph beginning at line 25 of page 41 has been amended as follows:

~~Fig. 18 is an~~ Figs. 18A-18C are explanatory ~~view~~ views showing an information reproducing apparatus according to Embodiment 7 of the invention.

Paragraph beginning at line 5 of page 42 has been amended as follows:

~~Fig. 20 illustrates~~ Figs. 20A, 20B-1, 20B-2 and 20C are explanatory views showing an information recording principle in the information recording apparatus shown in Fig. 19.

Paragraph beginning at line 17 of page 42 has been amended as follows:

~~Fig. 24 is an~~ Figs. 24A-24D explanatory view views showing modes of a memory medium in an information recording apparatus according to Embodiment 12.

Paragraph beginning at line 20 of page 42 has been amended as follows:

~~Fig. 25 is an~~ Figs. 25A-25D are explanatory view views showing states of an output signal of the information recording apparatus of Fig. 24.

Heading at line 23 of page 42 has been amended as follows:

~~BEST MODE FOR CARRYING OUT THE INVENTION~~
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Paragraph beginning at line 24 of page 42 has been amended as follows:

A detailed explanation will be given of the invention ~~in~~ with reference to the drawings as follows.

Paragraph beginning at line 1 of page 43 has been amended as follows:

Further, the invention is not limited by the embodiments ~~thereof.~~ described herein.

Heading at line 7 of page 76 has been deleted as follows:

~~INDUSTRIAL APPLICABILITY~~

Paragraph beginning at line 8 of page 76 has been amended as follows:

As has been explained, according to an information reproducing apparatus of the invention (~~Claim 1~~), a mark is irradiated with near-field light of linearly polarized light orthogonal to the mark and scattered light scattered by the mark is acquired as an output signal and accordingly, a recording density can be promoted.

Paragraph beginning at line 14 of page 76 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 2)~~, a plurality of marks of edges in a linear shape or the like are formed on a medium while changing directions thereof and the marks are irradiated with near-field light of linearly polarized light to thereby respectively provide output signals from the respective marks and therefore, the recording density can be promoted.

Paragraph beginning at line 21 of page 76 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 3)~~, a tracking mark in a linearly shape is formed in a scanning direction, near-field light of linearly polarized light orthogonal to the scanning direction is irradiated along the tracking mark and therefore, when a very small aperture for tracking is shifted from the tracking mark, an intensity of an output signal is changed. Therefore, tracking in reproduction can be executed based on the output signal. Further, when the tracking mark is formed in a direction different from a direction of a data mark, the tracking mark can be detected separately from the data mark

and accordingly, the recording density can be promoted by an amount of saving a tracking mark area.

Paragraph beginning at line 9 of page 77 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 4)~~, a tracking mark is formed in a scanning direction and a data mark is formed in a direction orthogonal to the scanning direction and the respective marks are irradiated with near-field light having linearly polarized light orthogonal to the respective marks to thereby provide output signals. Therefore, an area of the tracking mark can be reduced by forming the tracking mark and the data mark at a single pit or the like and accordingly, the recording density can be promoted by that amount.

Paragraph beginning at line 19 of page 77 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 5)~~, a data mark in a scanning direction and a data mark in a direction orthogonal to the scanning direction are scanned by near-field light of linearly polarized light orthogonal to the respective data marks. An output signal is intensified with regard to the data mark orthogonal to a direction of polarization of the

near-field light and accordingly, the data marks having directions of forming thereof different from each other can be detected respectively separately. Therefore, data can be constituted by multiple value formation and accordingly, the recording density can be promoted.

Paragraph beginning at line 5 of page 78 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 6~~), a data mark formed in a scanning direction is irradiated with near-field light of linearly polarized light orthogonal to the scanning direction to thereby provide an output signal, successively, a direction of polarization is rotated by polarized light rotating means and a data mark formed in a direction orthogonal to the scanning direction is irradiated with near-field light linearly polarized in the scanning direction to thereby provide an output signal. Therefore, the data marks in different directions are formed as a unit pit to thereby enable to promote the recording density. Further, an optical system is constituted by one route and therefore, apparatus constitution is simplified.

Paragraph beginning at line 19 of page 78 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 7~~), either one of the first data and the second data is subjected to bit shift and added to other thereof and accordingly, multiple value recording is made feasible and the recording density can be promoted.

Paragraph beginning at line 24 of page 78 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 8~~), the medium is scanned while irradiating near-field light a direction of polarization of which is rotating to data marks, scattered light scattered by the data marks constitutes output signals and multiple value data is acquired from intensities of the output signals and rotational angles of the direction of polarization. In this way, even when the data marks having different directions of forming thereof are formed at a unit pit, the data marks can separately be detected and therefore, multiple value formation is feasible and the recording density is promoted. Further, an optical system is constituted by one route and therefore, the apparatus structure is simplified.

Paragraph beginning at line 11 of page 79 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 9~~), based on recorded information, data marks in a linear shape are formed on a medium at predetermined intervals and the medium is scanned while irradiating the data marks with near-field light having linearly polarized light substantially orthogonal to the data marks. The data marks are detected by the above-described principle, the data marks are in the linear shape and accordingly, the data marks can be formed on the medium by a number larger than a number of conventional pits substantially in an elliptic shape. Therefore, the recording density can be promoted.

Paragraph beginning at line 23 of page 79 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 10~~), a plurality of data marks directed in different directions are provided as one unit, the data marks are irradiated with near-field light while rotating a direction of polarization thereof, multiple value data is acquired from intensities of output signals and, rotational angles of the direction of polarization and therefore, the recording density can be promoted.

Paragraph beginning at line 5 of page 80 has been amended as follows:

Next, according to an information recording apparatus of the invention (~~Claim 11~~), a direction of polarization of near-field light having linearly polarized light is changed based on recorded information and while changing the direction of polarization, near-field light is irradiated on a medium a surface of which is provided with a substance a state of which is changed by local heating. In this way, data marks having different directions can be formed at the same position and accordingly, multiple value formation is made feasible and the recording density can be promoted.

Paragraph beginning at line 15 of page 80 has been amended as follows:

According to an information recording apparatus of the invention (~~Claim 12~~), first data is recorded by irradiating a medium with near-field light polarized in a scanning direction by a very small aperture for first data recording and changing a state in a direction orthogonal to the second direction, similarly, second data is recorded by irradiating a medium with near-field light polarized in a direction orthogonal to the scanning direction by a very small aperture for second data recording and changing a state thereof in the scanning direction. Therefore, the first and

the second data can be recorded at the same position and accordingly, the recording density is promoted.

Paragraph beginning at line 1 of page 81 has been amended as follows:

Next, according to an information recording apparatus of the invention (~~Claim 13~~), first data is recorded by irradiating a medium with near-field light polarized in a scanning direction by a very small aperture for data recording and changing a state thereof in a direction orthogonal to the scanning direction, successively, second data is recorded by irradiating the medium with near-field light polarized in a direction orthogonal to the scanning direction and changing the state in the scanning direction. Further, directions of recording the first data and the second data may be reversed. In this way, information can be recorded by multiple value data at the same position and therefore, the recording density can be promoted.

Paragraph beginning at line 14 of page 81 has been amended as follows:

Next, according to an information recording apparatus of the invention (~~Claim 14~~), irradiation of near-field light, is controlled by a unit of a predetermined rotational angle based on recorded information and a state of

a medium in a direction orthogonal to a direction of polarization of the near-field light is changed by the unit of the rotational angle. Therefore, the recording density can be promoted.

Paragraph beginning at line 21 of page 81 has been amended as follows:

Next, according to an information recording apparatus of the invention (~~Claim 15~~), in the above-described information recording apparatus, the unit of the rotational angle is made to be equal to or larger than 10 degrees and accordingly, information can be recorded accurately.

Paragraph beginning at line 26 of page 81 has been amended as follows:

Next, according to an information reproducing apparatus of the invention (~~Claim 16~~), a phase plate is used, directions of polarization of near-field light generated from a first very small aperture and a second very small aperture are made to differ from each other and accordingly, marks of edges or the like having different directions of forming thereof can be detected separately for tracking and for data access. Therefore, even in the case of a recording medium in which a tracking mark and a data mark are formed at the same

position, reproduction of information and tracking can be executed.

Paragraph beginning at line 11 of page 82 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 17)~~, a phase plate is used, directions of polarization of finally generated near-field light are made to differ from each other and accordingly, marks of edges or the like having different directions of forming thereof can separately be detected. Therefore, promotion of the recording density can be achieved.

Paragraph beginning at line 18 of page 82 has been amended as follows:

Next, according to an information reproducing apparatus of the invention ~~(Claim 18)~~, there are provided a laser oscillator used for data access, a very small aperture for generating near-field light having linearly polarized light from laser light from the laser oscillator and polarized light controlling means for controlling a direction of polarization of the near-field light and therefore, marks of edges or the like having different directions of forming thereof can separately be detected by a simple constitution. Therefore, promotion of the recording density can be achieved.

Paragraph beginning at line 2 of page 83 has been amended as follows:

Next, according to a recording medium of the invention ~~(Claim 19)~~, a data mark of an edge or the like formed in one direction and a data mark of an edge or the like formed in a direction different from the direction are provided on a track. Therefore, by separately detecting the two data marks, the recording density can be promoted.

Paragraph beginning at line 8 of page 83 has been amended as follows:

Next, according to a recording medium of the invention ~~(Claim 20)~~, phase change layers in a longitudinal shape a state of each of which is changed by local heating are formed in a plurality of directions on a track and accordingly, multiple value formation of data is feasible and the recording density can be promoted.

Paragraph beginning at line 14 of page 83 has been amended as follows:

Next, according to an information reproducing method of the invention ~~(Claim 21)~~, near-field light of linearly polarized light orthogonal to a mark is irradiated on the mark and scattered light scattered by the mark is acquired as an

output signal and accordingly, the recording density can be promoted.

Paragraph beginning at line 20 of page 83 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 22~~), a plurality of marks of edges in a linear shape of the like are formed on a medium while changing directions thereof, the marks are irradiated with near-field light of linearly polarized light to thereby respectively provide output signals from the respective marks and therefore, the recording density can be promoted.

Paragraph beginning at line 1 of page 84 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 23~~), a tracking mark in a linear shape is formed in a scanning direction, the tracking mark is irradiated with near-field light of linearly polarized light orthogonal to the scanning direction along the tracking mark and accordingly, when the near-field light is shifted from the tracking mark, an intensity of an output signal is changed. Therefore, tracking in reproduction can be carried out based on the input signal. Further, when the tracking mark is formed in a direction different from a direction of a data

mark, the tracking mark can be detected separately from the data mark and accordingly, the recording density can be promoted by an amount of saving a tracking mark area.

Paragraph beginning at line 14 of page 84 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 24~~), a tracking mark is formed in a scanning direction, a data mark is formed in a direction orthogonal to the scanning direction and the respective marks are irradiated with near-field light having linearly polarized light orthogonal to the respective marks to thereby provide output signals. Therefore, an area of the tracking mark can be reduced by forming the tracking mark and the data mark at a single pit or the like and accordingly, the recording density can be promoted by that amount.

Paragraph beginning at line 24 of page 84 has been amended as follows:

~~Next, according to an information reproducing method~~ of the invention (~~Claim 25~~), a data mark in a scanning direction and a data mark in a direction orthogonal to the scanning direction are scanned by near-field light of linearly polarized light orthogonal to the respective data marks. An output signal is intensified with regard to the data mark

orthogonal to a direction of polarization of the near-field light and accordingly, the data marks having directions of forming thereof different from each other can respectively be detected separately. Therefore, multiple value formation can be constituted by data and accordingly, the recording density can be promoted.

Paragraph beginning at line 10 of page 85 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 26~~), an output signal is provided by irradiating a data mark formed in a scanning direction with near-field light of linearly polarized light orthogonal to the scanning direction, successively, a direction of polarization is rotated by polarized light rotating means and an output signal is provided by irradiating a data mark formed in a direction orthogonal to the scanning direction with near-field light linearly polarized in the scanning direction.

Therefore, the recording density can be promoted by forming the data marks having different directions as a unit pit.

Paragraph beginning at line 21 of page 85 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 27~~), either one of the first data and

the second data is subjected to bit shift and added to other thereof and therefore , multiple value recording is made feasible and the recording density can be promoted.

Paragraph beginning at line 11 of page 86 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 29~~), data marks in a linear shape are formed on a medium at predetermined intervals based on recorded information and the medium is scanned while irradiating the data marks with near-field light having linearly polarized light substantially orthogonal to the data marks. The data marks are detected by the above-described principle and the data marks are formed in the linear shape and accordingly, the data marks can be formed on the medium by a number larger than a number of conventional pits substantially in an elliptic shape. Therefore, the recording density can be promoted.

Paragraph beginning at line 22 of page 86 has been amended as follows:

Next, according to an information reproducing method of the invention (~~Claim 30~~), a plurality of data marks directed in different directions are provided as one unit, the data marks are irradiated with near-field light while rotating

a direction of polarization, multiple value data is acquired from intensities of output signals and rotational angles of the direction of polarization and accordingly, the recording density can be promoted.

Paragraph beginning at line 4 of page 87 has been amended as follows:

Next, according to an information recording method of the invention (~~Claim 31~~), a direction of polarization of near-field light having linearly polarized light is changed based on recorded information and while changing the direction of polarization, the near-field light is irradiated on a medium a surface of which is provided with a substance a state of which is changed by local heating. In this way, data marks having different directions can be formed at the same position and accordingly, multiple value formation is made feasible and the recording density can be promoted.

Paragraph beginning at line 14 of page 87 has been amended as follows:

Next, according to an information recording method of the invention (~~Claim 32~~), first data is recorded by irradiating a medium with near-field light linearly polarized in a scanning direction and changing a state thereof in a direction orthogonal to the scanning direction,

similarly, second data is recorded by irradiating the medium with near-field light linearly polarized in a direction orthogonal to the scanning direction and changing the state in the scanning direction. Therefore, the first and the second data can be recorded at the same position and accordingly, the recording density is promoted.

Paragraph beginning at line 25 of page 87 has been amended as follows:

Next, according to an information recording method of the invention (~~Claim 33~~), first data is recorded by irradiating a medium with near-field light polarized in a scanning direction and changing a state thereof in a direction orthogonal to the scanning direction, successively, second data is recorded by irradiating the medium with near-field light polarized in a direction orthogonal to the scanning direction and changing the state in the scanning direction. Further, directions of recording the first data and the second data may be reversed.

In this way, information can be recorded by multiple value data at the same position and accordingly, the recording density can be promoted.

Paragraph beginning at line 11 of page 88 has been amended as follows:

Next, according to an information recording method of the invention (~~Claim 34~~), irradiation of near-field light is controlled by a unit of a predetermined rotational angle based on recorded information and a state of a medium in a direction orthogonal to a direction of polarization of the near-field light is changed by the unit of the rotational angle. Therefore, the recording density can be promoted.

Paragraph beginning at line 18 of page 88 has been amended as follows:

Next, according to an information recording method of the invention (~~Claim 35~~), in the above-described information recording method, the unit of the rotational angle is made to be equal to or larger than 10 degrees and accordingly, information can be recorded accurately.